NOVEMBER/DECEMBER 2024

23PEMA24B — MATHEMATICAL STATISTICS

SHANMUGA INDUSTRIES ARTS & SCIENCE COLLEGE
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Time : Three hours Maximum : 75 marks

SECTION A — (10 × 2 = 20 marks)

Answer ALL questions.

1. Explain Statistic.
2. What is statistic χ^2?
3. Define non-centrality parameter.
4. Define Pearson's χ^2 statistic.
5. Define Statistical Hypothesis.
6. Write about parametric test.
7. Define Contingency table.
8. Discuss about consistent estimates.
9. Define unbiased estimate.
10. What is known as bias of the estimate?

(b) Suppose that we have a simple sample of $n = 50$ elements drawn from a population in which the characteristic X has a distribution with the standard deviation $\sigma = 5$ and an unknown expected value m. From the sample we have obtained $\bar{x} = 2$. The problem is to test the $H_0(m = 0)$.

14. (a) Consider the class D of distribution functions of random variables X whose second moments exist. Let the variance σ^2 of X be unknown. As an estimate of this parameter, we take the statistic $S^2 = \frac{1}{n}\sum_{k=1}^{n} X_{k^2} - \bar{X}^2$, where the random variables X_k are independent and have the same distribution as X. Where the statement follows unbiased estimate if explain in brief?

Or

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(b) The characteristic X of elements of a certain population has the normal distribution $N(m,\sigma)$ where the expected value m is known but the standard deviation σ is not known If the static S_0^2 is unbiased estimator of σ^2. Show that S_0 is not unbiased estimate of σ.

15. (a) Let V be an unbiased estimate of the parameter Q, and let U be a sufficient estimate of Q. Then the random variable $E(V/u)$ is an unbiased estimate of Q. If, moreover, the variance $D^2(V)$ exists, the inequality $D^2[E(V/u)] \leq D^2(V)$ holds.

Or

(b) The characteristic X of elements of a population has the Cauchy distribution given by the density $f(x) = \frac{1}{\pi[1 + x - Q]^2}$, where Q is an unknown parameter. Find the minimum variance of a regular and unbiased estimate U of Q.

SECTION C — ($3 \times 10 = 30$ marks)

Answer any THREE questions.

16. Write about the X^2 distribution.

17. Define Fisher's Z distribution.